

Appendix C

IMAGERY RESEARCH AND ANALYSIS

I. Introduction

In November 1999, The Department of the Army Inspector General Review Team (U.S. Review Team) requested that the Defense Intelligence Agency (DIA) survey its archives for photographic or textual records of the Republic of Korea (ROK) during the Korean War. The U.S. Review Team asked DIA to focus on the period from July 25 to November 1, 1950. DIA found no textual records but identified two aerial reconnaissance missions flown on August 6 and September 19, 1950, that were catalogued as mission numbers R-377A and R-110A flown over the No Gun Ri area along a mission track that included the Yongdong-Hwanggan corridor.

Following this discovery, the U.S. Review Team formally requested that the National Imagery and Mapping Agency (NIMA), the Department of Defense functional proponent on matters relating to imagery and aerial reconnaissance, perform an analysis of the aerial reconnaissance film¹¹. The Republic of Korea's Image Analysis Team, Aerial Imagery Intelligence Squadron, 39th Tactical Reconnaissance Group, Republic of Korea analyzed the film on behalf of the ROK Review Team². Both examinations focused on the road, rail lines, tunnels and bridges³. NIMA was further tasked to search for possible mass gravesites and evidence of human remains along the Yongdong-Hwanggan portion of the film.

II. Imagery Research Chronology of Events

Defense Intelligence Agency Holdings.

DIA searched its holdings after receiving the U.S. Review Team's request in November 1999. DIA 's first search parameter was for any material showing the No Gun Ri area during the period 25 July to 1 November 1950. Although this search produced no textual records, DIA did find two canisters of overhead reconnaissance film dated August 6 and September 19, 1950. Continuing its search, DIA found 148 more canisters of imagery that were candidates for review. A physical examination of these 148 canisters in December 1999 and January 2000 determined that this film did not contain pictures of the No Gun Ri area. Throughout the searches, the advanced age and fragile condition of the film required special handling, to protect the film.

Washington National Record Center Holdings.

In mid-January 2000 the U.S. Review Team expanded its film search into the holdings of the Washington National Records Center (WNRC), Suitland, Maryland, and to the National Archives and Records Administration II (NARA II), College Park, Maryland to ensure our search was as thorough as possible.

In November 1999, DIA had compiled a massive list of aerial photography held by WNRC that might contain reconnaissance film over the Republic of Korea and the Yongdong-No Gun Ri Area of Interest (AOI). The U.S. Review Team, with the DIA list as a finding aid, narrowed the timeframe parameter for the physical search to the period July 25 to August 5, 1950 using the August 6, 1950 film as a data point.

From March to June 2000, the U.S. Review Team members, assisted by WNRC employees, painstakingly searched through individual film canisters (each one approximately 12 inches high, six inches in diameter, and weighing several pounds). The imagery is stored in boxes with up to five cans in a box, two boxes deep on a shelf and up to seven rows high. The imagery on the original negatives was handled carefully. Ultimately, the U.S. Review Team examined over 45,000 film canisters. The WNRC search occurred in three phases:

Phase one was a database survey of records DIA had identified as likely candidates containing Republic of Korea, 1950, aerial photography. This database had complete identification information (such as location and date) that greatly expedited locating these materials in the stacks. This identification information permitted rapid culling of relevant boxes in which to search. Many of the canisters had complete labels that made determining relevance easy. However, some of the canisters identified in this phase had incomplete identification data on them. For the canisters with incomplete data, the U.S. Review Team physically examined each canister. None of the canisters contained No Gun Ri related material.

Phase two was the physical search of more record groups, derived from a second database that DIA identified as possibly containing 1950 Republic of Korea aerial photography. However, this database listing contained no inventory of the individual cans in the record groups. Therefore, this phase took longer because the researchers needed to open every box in the record groups. This task involved thousands of boxes and film canisters. No relevant materials were discovered.

Phase three, the final phase consisted of physically searching unlisted record groups that might fit our parameters. This phase used the NARA Accession Number Master List, WNRC, as a search tool. This method represented the least specific data tool. It would cover the remainder of any

known or suspected Korean War materials for the period in question and fulfill our mandate. No relevant materials were discovered.

Upon completion of the search, the U.S. Review Team surveyed and examined over 45,000 canisters of aerial reconnaissance film that yielded a total of 260 canisters of potentially relevant aerial imagery. Close examination of these 260 canisters revealed that none were from the No Gun Ri area. The August 6 and September 19, 1950 film were the only useful photographic products derived from this effort.

National Archives and Records Administration II

In January and February 2000, the U.S. Review Team examined NARA II holdings and found several canisters of Korean Era gun-camera footage. No footage was from the No Gun Ri area. As the search continued, the U.S. Review Team located additional gun-camera film in June 2000. The U.S. Review Team asked NIMA to assess this imagery. The film segment consisted of 31 usable frames of film covering approximately 1.25 seconds in "real time." The scene consisted of a double railroad track with a road paralleling it. Both the road and railroad crossed a secondary stream where it joined a larger primary stream. Although analysts could not determine the location of the activity, it was evident, when compared to the August 6 and September 19, 1950, film, that this was not the No Gun Ri area. Therefore, it will not be discussed any further.

III. The August 6 and September 19, 1950 Film

The 8th Tactical Reconnaissance Squadron, 5th Air Force, flew both reconnaissance missions. The film sets contained embedded reconnaissance track frames that enabled the analysts to identify positively the Yongdong-Hwanggan corridor, the No Gun Ri railroad overpass, Highway 1, and other salient features⁴.

The film format is 9 inch X 9 inch taken by vertical cameras with a focal length of 152mm (6 inch). NIMA rated the quality of the film as "good" with a National Imagery Interpretability Rating Scale (NIIRS) of "7" (Cultural Features: Identify individual railroad ties). The altitude for the August 6 mission was 3500 feet while the 19 September's mission was 3800 feet. The August 6, 1950 film was the primary focus for analysis since it was closer to the time frame of the alleged incident. Analysts used the September 19 film for comparison with the August 6 film, looking for changes or other disturbances in the terrain for comparative purposes.

The U.S. Review Team asked NIMA to analyze the two reconnaissance missions along the track from Yongdong to Hwanggan. NIMA's task was to analyze and assess the state of the road, rail lines, tunnels and bridges, and look for possible gravesites and evidence of human remains.

The ROK Review Team's imagery analyst also examined and provided an analysis of the August 6, 1950, aerial reconnaissance film. The ROK Review Team raised several independent concerns and noted differences between the US and ROK evaluation. Therefore, the U.S. Review Team requested NIMA reexamine the film with the intent of responding to the concerns expressed by the ROK Review Team in an effort to answer remaining questions and ensure that a thorough analysis of the August 1950 film had been achieved⁵. After review of the ROK analysis of the aerial reconnaissance film and a meeting with the ROK Team's imagery analyst and a reexamination of the film, NIMA's original conclusions remained unchanged.⁶

IV. Description and Analysis

The description and analysis of the area shown in the photographs follows below.⁷

A loose surface, all-weather road runs parallel to the east side of the dual rail line. This road is identified as Route 1 on the 1957 Yongdong map (designated as the Highway 4/Kyoung Bu Expressway on contemporary maps)⁸. Approximately 30 meters east of the double overpass on Route 1 is an intact highway bridge. This bridge is approximately 5 meters wide, 20 meters long, and 3.5 meters high; it spans the same streambed as the double overpass. Approximately 220 meters south of the double overpass on the west rail line is a 50-meter section of track that has damage patterns consistent with the results of possible strafing (361249N 1275244E). Just east of the damaged area, and at the base of the rail embankment, is a line of fighting positions. Between the double overpass and the Route 1 highway bridge are vehicle tracks fording the stream.

Approximately 55 meters further upstream from the ford to the east is the start of a line of fighting positions on the south bank of the streambed. This line of fighting positions starts at the bend of the stream and extends for approximately 250 meters to the south.

Approximately 300 meters east of the double overpass along Route 1 is a disrupted road bridge as it appears on the August 6, 1950 film. The bridge is reconstructed in the September 19, 1950 film.

Approximately 260 meters due east of the double overpass is Hill 207, which reveals burial mounds and fighting positions. There is evidence of ordnance impact throughout the area.

Located about 200 meters southwest of the No Gun Ri Railroad Bridge is a small area⁹ (361226N 1275231E) that has damage patterns consistent with the

results of probable strafing¹⁰. This field extends about 50 meters along the west track bed.

Located about 1200 meters southwest of the No Gun Ri Railroad Bridge is a large area¹¹ (36126N 1275231E) that has damage patterns consistent with the results of probable strafing. This field extends about 50 meters along both sides of the track bed.

The August 6 imagery appears to have been taken during midday as indicated by the limited shadowing exhibited by the various structures and vegetation. This is verified by annotations that appear on the various frames throughout out the reconnaissance track.

V. Conclusions

The NIMA analysis drew the following conclusions:

There are no indications of human remains or mass graves in, under, or around the No Gun-Ri overpass or culvert or surrounding area¹².

The road bridge immediately east of the double overpass does not appear to have undergone recent construction prior to the date of the image¹³.

Probable strafing occurred in two locations along the western track bed¹⁴. The analyst ruled out that artillery, mortars, or standard aerial bombs caused the ground marks.

Entrances to the various tunnels all appeared intact and open. There is evidence of probable bomb craters noted in the vicinity of the various tunnel openings.

The September 19, 1950 images showed that the disrupted road bridge in the August 6, 1950 film had been rebuilt.

The September 1950 film provided no **significant** additional information.

¹ NIMA Imagery Analysis Report No Gun Ri, Republic of Korea 6 August 1950 and 19 September 1950.

² Working papers provided to the US Team entitled Analysis on Overhead Imagery.

³ The U.S. Review Team provided a duplicate negative of the 6 August and 19 September 1950 missions to the ROK Team.

⁴ Lead frame is a photograph of a section of a 1:250,000 map reference J52T - J52U showing the flight path and approximate location of film frames.

⁵ NIMA Imagery Analysis Review and Comments on the Republic of Korea's No Gun-Ri Investigation Team's "Analysis on Overhead Imagery" Date of Imagery 6 August 1950.

⁶ Supplemental comments were provided by NIMA on 3 November 2000.

⁷ See Figures 1 - 4 NIMA Imagery Analysis Report No Gun Ri, Republic of Korea 6 August 1950 and 19 September 1950

⁸ Map Sheet HWANGGAN, Series L754, Sheet 3318 III

⁹ NIMA Analyst identified this area as "probable northeast strafed area." (See Tab 2, App D, P.11)

¹⁰ The ROK analyst identifies this area as "artificial patterns... (Estimated not due to air strike)"

¹¹ NIMA Analyst identified this area as "probable southwest strafed area." (See Tab 2, App D, P.11)

¹² The ROK imagery analyst concurred with this conclusion. It had been reported that remains were present as late as 10 August 1950. According to NIMA, the quality of the 6 August 1950 film was good enough that an object the size of a human body roughly between 4 and 6 feet in height would have been visible.

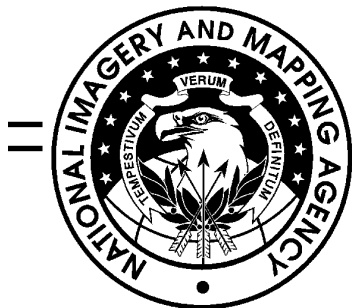
¹³ It was reported that the bridge was down between 26 July 1950 and was rebuilt prior to the date of the aerial photograph

¹⁴ These are the two areas described on page 7

Appendix C

Tab 1

NIMA Imagery Analysis Report No Gun-Ri, Republic of Korea 6 August 1950 and
19 September 1950



Imagery Analysis

NIMA Imagery Analysis Report

No Gun-Ri, Republic of Korea

6 August 1950 and 19 September 1950

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Appendices

- 1. Bridges and Culverts
- 2. Analyst Comments

I. Introduction

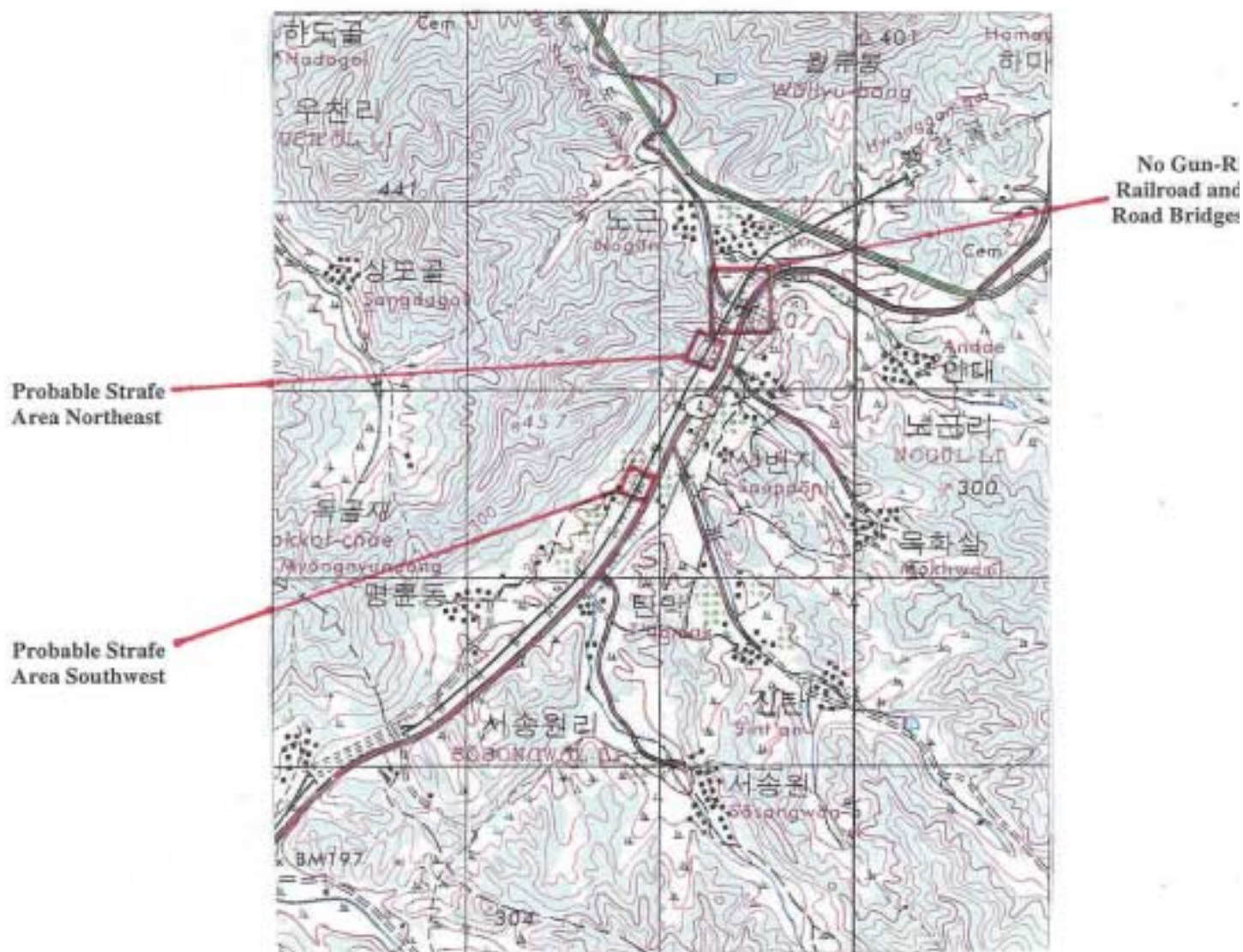
1. The National Imagery and Mapping Agency (NIMA) was formally requested by the US Army Inspectors General Office to review a segment of gun camera film reportedly taken in the vicinity of No Gun-Ri, Republic of Korea (ROK) during July - August 1950. Additionally, NIMA was specifically requested to "conduct analysis on two reconnaissance missions flown on 6 August and 19 September 1950, respectively, between Yongdong and Hwanggan, ROK (Map 1). The primary focus (of the analysis) should be bridges, tunnels and possible areas of mass graves. In addition, look for evidence of strafing damage and human remains."

2. Upon discussions with the assigned US Army Inspectors General Investigator, it was decided that the 1950 reconnaissance missions would be examined in their entirety for evidence of road, railroad, and bridge damage. Emphasis would be placed on those frames in the vicinity of the No Gun-Ri, ROK railroad bridge (Map 2) -- particularly in the search for human remains and mass graves (Figures 1 - 4 overlap -- from right to left -- to define interest area).



Area of Interest (Annotated)

Map 1



Map Sheet HWANGGAN, Series L754, Sheet 3318 III



VICINITY NO GUN-RI, ROK
06AUG50



FIGURE 2

VICINITY NO GUN-RI, ROK
06AUG50



FIGURE 3

VICINITY NO GUN-RI, ROK
06AUG50

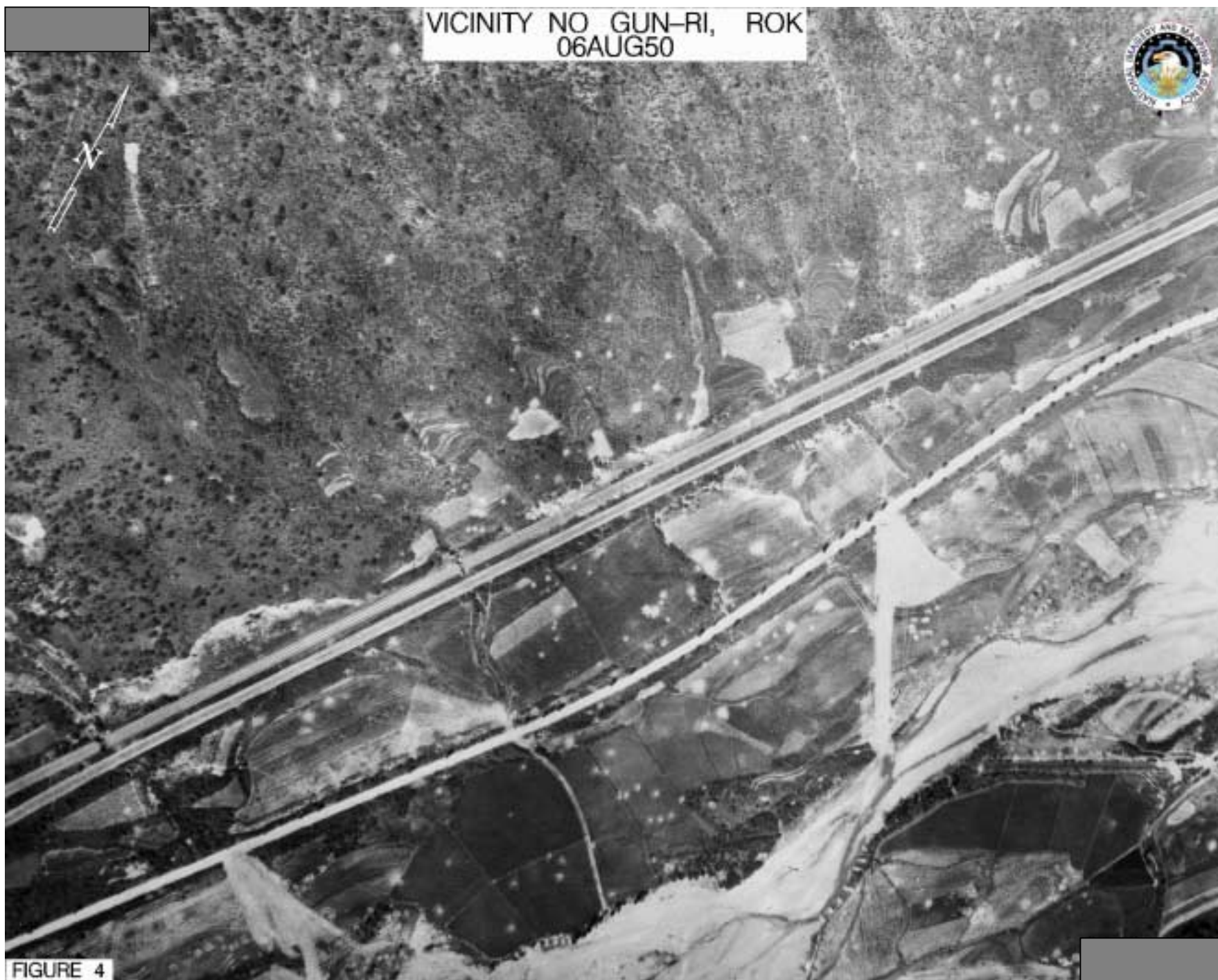
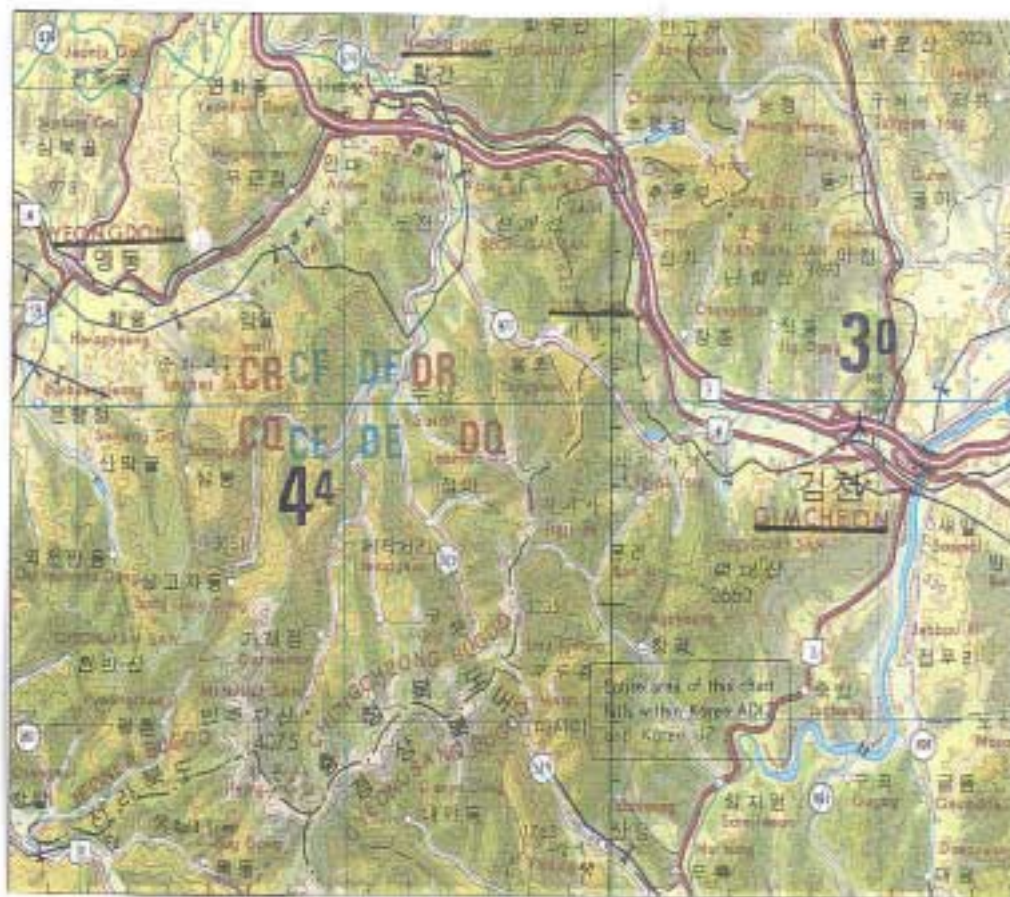


FIGURE 4

II. Equipment and Techniques

1. Evaluation and analysis of the gun camera film was conducted by initially viewing the segment of film in question on a 16mm motion picture viewer at the National Archives, College Park facility. The film was then transported to the photo lab of the Defense Intelligence Analysis Center, Bolling AFB, Washington DC, where the film segment was digitized in a 2k by 2k format, producing 31 discrete image files. The image files were placed on a DIA fileserver in a shared directory. NIMA personnel at Building 213, Washington Navy Yard, pulled the files via the Joint Worldwide Intelligence Communications System (JWICS) into an ULTRA 60 workstation, where they were transferred to an 8mm tape and moved to an INTERGRAPH system for viewing and analysis.
2. Evaluation and analysis of the 6 August 1950 and 19 September 1950 was performed on fourth generation Duplicate Positive (DUPPOS) film (transparency)¹. Analysis was performed at Building 213, using a RICHARDS HFO-4 Light Table, equipped with a Bausch and Lomb Zoom 500 Stereoscope, Bausch and Lomb 15X Ultra Wide Field eyepieces, 1X and 4X (Bausch and Lomb) and 1.25X (Cambridge Instruments) optics (objectives).
3. Standard analytical techniques were used -- mono-viewing, stereo-viewing, enlargement (via zoom capabilities of the stereoscope and the various available optics) and varying the light intensity.
4. Selected frames of both the 6 August 1950 imagery (frames 15, 32, 33, 34, 35, 36, and 40) and the 19 September 1950 imagery (frames 43 - 49) were digitized by DIA and provided to NIMA on an 8mm tape. Third generation negatives were used as the base media for the digitization. The digitized images were NOT used for analysis, instead they were used only for the production of the various graphics/prints used in this report.

¹ At the time of this analysis, the Original Negative (ON) of this imagery was in the possession of DIA. To support the IG investigation several second generation copies had been made from the ON resulting in damage to the ON. By the time NIMA was requested to provide an analysis, DUPPOS copies were being made from a third generation Duplicate Negative (DUPNEG). While generational degradation had occurred, loss of quality was deemed insufficient to affect overall analysis.



Map series 1501 Air, Sheet NJ 52-14, Edition 4

Map 3

III. Film Quality Assessment

1. **Gun Camera Film** - The film provided for the tasked review/assessment was standard 16mm motion picture film. There was no accompanying location/date data provided with the film (National Archives researchers stated that they believed it to have been taken in the vicinity of No Gun-Ri during the July/August 1950 timeframe). The following identifying data was found on the film: 342USAF18823 R-3 REEL 3/4 B-WIND KODAK SAFETY POSITIVE.

Provided film was a copy (frames where segments were connected showed an "oval," but were otherwise blank (opaque), no true cuts or splices were noted). Film quality was fair, the images appeared grainy and showed signs that both the original and the copy were probably scratched. Motion within the tasked segment was smooth, possibly indicating that the aircraft guns were not firing while the camera was activated.

2. **6 August 1950 Imagery** - This was a 9 inch x 9 inch format film taken with an unknown model framing camera. According to the mission data provided on the film leader, the mission was flown by the 5th Air Force (5AF), as sortie/mission number 337A. The camera had a focal length of 152mm (6 inches) and was flown at an altitude of 3500 feet. The scale of the resulting imagery was calculated by the imagery analyst at 1:7000²; resolution was such that individual railroad ties could be distinguished under magnification. The provided film was a fourth generation DUPPOS and quality of the resulting film was rated by the analyst as good, with a National Imagery Interpretability Rating Scale (NIIRS) rating of 7.³ Imagery appeared to have been taken at midday -- minimal shadowing was exhibited by various structures and vegetation. Imagery covered an area from Sinan-ni (Sinan-Yeong⁴) to Yongdong (Yeongdong), ROK (see Map 3).

3. **19 September 1950 Imagery** - This was also a 9 inch x 9 inch format film taken with an unknown model framing camera. According to the mission data provided on the film leader, the mission was flown by the 5th Air Force (5AF), as sortie/mission number 1105A. The camera had a focal length of 152mm (6 inches) and was flown at an altitude of 3800 feet. The scale of the resulting imagery was calculated by the imagery analyst at 1:7600, resolution was again such that individual railroad ties could be distinguished under magnification. The provided film was again a fourth generation DUPPOS, and was rated by the analyst as good, also with a NIIRS rating of 7. Imagery appeared to have been taken at

² Scale was determined using the following formulas: Photo Scale Reciprocal (PSR) = Altitude (height) in Feet times 12 divided by focal length in inches (F) or $H \times 12 / f = \text{PSR}$; Scale (S) = 1 divided by PSR or $S = 1 / \text{PSR}$ (or it can be expressed $S = 1 : \text{PSR}$).

³ Under the NIIRS rating system, values of 0-9 are used (imagery rated 0 is poor quality and uninterpretable, while imagery rated as 9 is excellent quality. Imagery on which individual railroad ties can be distinguished, for example, is given a NIIRS rating of 7.

⁴ Spelling differences for place names are found on the various maps used in this analysis.

midday -- minimal shadowing was exhibited by various structures and vegetation. Imagery covered an area from Kimchon (Gimcheon) to Yongdong (Yeongdong), ROK (see Map 3).

IV. Gun Camera Film Assessment

1. The film segment in question consisted of 31 usable frames of film, covering approximately 1.25 seconds in "real" time.
2. The segment showed a road paralleling a closely separated double railroad track and corresponding rail and road bridges crossing a secondary stream near where it joined a larger primary stream. Both bridges appeared damaged.
3. The gun camera film provided was NOT taken in the vicinity of No Gun-Ri along the road/railroad between Yongdong and Hwanggan - the railroad between these two areas was a double railroad, most of the distance displaying a marked degree of separation between the two rail beds. Further there was a marked separation between the railroad and the road, except in the immediate vicinity of No Gun-Ri where the road and railroad run in close proximity. Additionally at No Gun-Ri, the road/railroad crossed a primary stream - not a secondary stream as depicted in the gun camera film (Figure 5).
4. While the gun camera film may have been taken during the July - August 1950 time period as the National Archives researchers believed, where it was taken is not known. Furthermore it was not taken in the areas imaged on the 6 August 1950 and 19 September 1950 imagery provided to NIMA for analysis.



GUN CAMERA FILM
UNKNOWN LOCATION
UNKNOWN DATE



FIGURE 5

V. Analysis of 6 August 1950 Imagery

A. Bridges

1. On imagery between Kimchon and Yongdong, ROK, 35 separate bridges (this count includes both rail and road bridges, culverts, and overpasses) were noted. Geographic coordinates are provided in Appendix A.⁵
2. All overpasses, culverts, railroad and road bridges were intact and appeared serviceable, except a road bridge near the No Gun-Ri railroad bridge located at 361258N 1275259E (Figures 6 and 7) and the Wonsabu railroad bridge located at 361254N 1275759E (Figure 8), both of which were unusable.
3. No bridges appeared to have undergone any recent repair.

⁵ All provided coordinates are based on film to map correlation, coordinates were NOT mensurated. Coordinates were derived from Map Sheet HWANGGAN, series L754, Sheet 3318 III, WGS 84. UTM coordinates were converted to Geographic Coordinates via the Coordinate Conversion Program in the National Exploitation System (NES).





VICINITY NO GUN-RI, ROK
361258N1275259E 06AUG50



FIGURE 7



WONSABU BRIDGE, ROK
361254N1275759E 06AUG50



FIGURE 8

V. Analysis of 6 August 1950 Imagery

B. Tunnels

1. Two railroad tunnels were noted between Hwanggan and Yongdong. Craters caused by various types of munitions were noted throughout the areas in the vicinity of the tunnels.
2. The tunnel in the vicinity of Hwanggan near 361141N 1275140E (north most opening), extended approximately 750 meters on a northeast to southwest orientation. The approaches at each end appeared intact and no debris was noted around the openings on the tracks.⁶
3. The tunnel in the vicinity of Mugunjom near 361329N 1275350E (north most opening), extended approximately 500 meters, also on a northeast to southwest orientation. The approaches at each end appeared intact and no debris was noted around the openings on the tracks (Figure 9).

⁶ The imagery analyst chose NOT to provide a print of the Hwanggan railroad tunnel from the 6 August 1950 imagery. The entire tunnel was not imaged on a single frame, and the location of the tunnel entrances on the available frames would have made resulting prints confusing to the reader.



VICINITY MUGUNJOM, ROK
RAILROAD TUNNEL
361329N1275350E 06AUG50



FIGURE 9

VICINITY NO GUN-RI, ROK
RAILROAD AND HIGHWAY BRIDGES
361257N1275250E 06AUG50



FIGURE 10

V. Analysis of 6 August 1950 Imagery

C. Mass Graves

1. There were no indications of mass graves in the vicinity of the No Gun-Ri Railroad bridge.⁷ (Figure 10)
2. Fighting positions (foxholes) were noted along the river, extending from the bend in the river east of the highway bridge (361255N 1275255E) along the river/stream bank southwest to approximately 361235N 1275247E (Figures 11 and 12). A heavy concentration of fighting positions was massed in the vicinity of 361229N 1275259E. Stereoscopic examination of the fighting positions revealed that the majority were open (meaning not filled in or covered over) (Figure 13).

⁷ Analyst Comment: The "signature" or appearance of mass graves may depend upon terrain and cultural factors as well as the circumstances that have forced the decision to create a mass grave, i.e. natural disaster, disease, mass executions, etc. The signature that an imagery analyst searches for is a newly dug linear trench or rectangular-appearing pit. Typically mass graves have been located on imagery, after the grave has been filled and covered and when some other indicators have pointed the analyst in the right direction to look.

VICINITY NO GUN-RI, ROK
06AUG50



FIGHTING POSITIONS

FIGHTING POSITIONS



FIGURE 11

VICINITY NO GUN-RI, ROK
FIGHTING POSITIONS
06AUG50



FIGURE 12

VICINITY NO GUN-RI, ROK
FIGHTING POSITIONS
361229N1275259E 06AUG50



FIGURE 13

V. Analysis of 6 August 1950 Imagery

D. Human Remains. The area around the No Gun-Ri, ROK railroad bridge and the nearby fighting positions was carefully examined for indications of human remains. There were NO indications of human remains found on the imagery examined for this project.

V. Analysis of 6 August 1950 Imagery

E. Strafing

1. An imagery signature of probable strafing was noted on the 6 August 1950 imagery in two areas, near the No Gun-Ri railroad bridge.
2. The probable northeast strafed area was located at 361249N 1275244E (Figures 14 and 15). This location, approximately 200 meters southwest of the No Gun-Ri railroad bridge, was on the western track bed. Extending approximately 50 meters along the track bed was a random pattern of light toned "circular" and "irregularly" shaped marks or craters. These marks exhibited the same tonal qualities as nearby probable bomb craters, appearing to be of the same material (probably disrupted dirt) as the bomb craters. Examination of these light toned marks using frames 34 and 35, and standard stereoscopic techniques indicated that the marks had no "height", meaning that the marks were on the surface of the ground or only slightly depressed or evenly mounded. No shadows were noted at any of ground marks. The analyst conclusion was that the area had probably been strafed by an aircraft; the pilot was able to concentrate his firing along the western trackbed.⁸ Cratering / soil disruption was noted on the embankments in this area.
2. The probable southwest strafed area was located at 361226N 1275231E (Figures 16 and 17). This location, approximately 1200 meters southwest of the No Gun-Ri railroad bridge, was also situated along the western track bed. Like the probable northeast strafed area, the southwest site extended for approximately 50 meters. Unlike the northeast area, which was concentrated on the track bed, the southwest site extended along both sides of the trackbed. Numerous small craters, too small to have been made by artillery, mortars or standard aerial bombs, appeared clustered in a line on either side of the tracks in that area and on the embankments lining the tracks.

⁸ This concentration of craters (or soil disruption) within the trackbed and size of the marks caused the analyst to rule out: artillery, mortars, and standard aerial bombs. The analyst further ruled out "scattered refugee belongings", because of the uniform light tone (white) of the marks (craters) -- it was felt that "refugee belongings" would exhibit "gray tones" resulting in a more mottled appearance of the area.

VICINITY NO GUN-RI, ROK
06AUG50



PROBABLE STRAFE AREA NORTHEAST

FIGURE 14

VICINITY NO GUN-RI, ROK
PROBABLE STRAFE AREA NORTHEAST
361249N1275244E 06AUG50



FIGURE 15

VICINITY NO GUN-RI, ROK
06AUG50



PROBABLE STRAFE AREA SOUTHWEST

FIGURE 16

VICINITY NO GUN-RI, ROK
PROBABLE STRAFE AREA SOUTHWEST
361226N1275231E 06AUG50



FIGURE 17

VI. Analysis of 19 September 1950 Imagery

A. Bridges All railroad and road bridges were intact and appeared serviceable except the Wonsabu Railroad bridge located at 361254N 1275759E. The damaged road bridge located at 361258N 1275259E, had been repaired between 6 August and 19 September 1950 (Figure 18).

VICINITY NO GUN-RI, ROK
361258N1275259E 19SEP50



FIGURE 18

VI. Analysis of 19 September 1950 Imagery

B. Tunnels There was no change in the status of the two tunnels reported on the 6 August 1950 imagery. The approaches at each end of both the Hwanggan and Mugunjom railroad tunnels appeared intact, with no debris noted around the openings on the tracks (Figures 19 and 20). Additional munitions cratering had occurred in the area of both tunnels between the 6 August 1950 and 19 September 1950 imagings.



VICINITY MUGUNJOM, ROK
RAILROAD TUNNEL
361329N1275350E 19SEP50



FIGURE 20

VI. Analysis of 19 September 1950 Imagery

C. Mass Graves

1. There were still no indications of mass graves in the vicinity of the No Gun-Ri Railroad bridge.
2. The previously identified fighting positions (foxholes) were still visible along the river, extending from the river bend east of the highway bridge along the river/stream bank to the southwest (Figure 21). The heavy concentration of fighting positions noted at 361229N 1275259E remained. Stereoscopic examination of the fighting positions revealed that the majority were still open (meaning not filled in or covered over) (Figure 22). Most of the positions were showing the effects of weathering, having begun to collapse over time.

VICINITY NO GUN-RI, ROK
RAILROAD AND HIGHWAY BRIDGE
361257N1275250E 19SEP50



FIGURE 21

VICINITY NO GUN-RI, ROK
361229N1275259E 19SEP50



FIGURE 22

VI. Analysis of 19 September 1950 Imagery

D. Human Remains The area around the No Gun-Ri, ROK railroad bridge and the nearby fighting positions was carefully examined for indications of human remains. There were NO indications of human remains found on the imagery examined for this project.

VI. Analysis of 19 September 1950 Imagery

E. Strafing

1. The imagery signature of probable strafing noted on the 6 August 1950 imagery was less evident on 19 September 1950.
2. The probable northeast strafed area located at 361249N 1275244E (Figure 23), still exhibited the effects of the probable strafing; the ground surface between the rails appeared uneven and presented a "pockmarked" feel when viewed in stereo. The time interval between 6 August and 19 September 1950 allowed the scene to "weather" -- returning the rail bed in the probable strafed area to a more uniform gray tone. The rails through the probable strafed area appeared intact, however at one location it appeared that the tracks may have been bowed outward slightly and several of the cross ties appeared to be missing and broken. Some probable gouges or craters were still visible along the embankment walls.
3. The probable southwest strafed located at 361226N 1275231E (Figure 24), exhibited the same weathering effects, hiding the numerous small craters along the sides of the track.
4. It should be noted that most of the craters in both areas caused by other munitions of various types showed this same weathering effect, darkening in the later coverage.

VICINITY NO GUN-RI, ROK
PROBABLE STRAFE AREA NORTHEAST
361249N1275244E 19SEP50



FIGURE 23

VICINITY NO GUN-RI, ROK
PROBABLE STRAFE AREA SOUTHWEST
361226N1275231E
19SEP50



FIGURE 24

VII. Conclusions

1. The areas imaged on both 6 August 1950 and 19 September 1950 exhibited evidence of military operations. Numerous craters caused by munitions of various types were found throughout the area.
2. Two bridges were damaged as noted on the 6 August 1950 imagery; one bridge had been repaired by 19 September 1950. There were no indications of any bridge having undergone repair on the 6 August 1950 imagery.
3. Probable strafing resulting in disruption of the soil along the railbed, occurred in two locations within 2000 meters of the No Gun-Ri railroad bridge. Imagery analysis has ruled out artillery, mortars, standard aerial bombs or refugee property as the cause of the disrupted appearance of the areas.
4. Entrances to the various railroad tunnels all appeared intact and open.

Appendix 1

Bridges and Culverts

Visible/Located on Imagery

Kimchon to Simchon

1. 360733N 1280523E
2. 360727N 1280522E
3. 360727N 1280508E
4. 360735N 1280448E
5. 360718N 1280440E
6. 360746N 1280359E
7. 360755N 1280302E
8. 360807N 1280203E
9. 360748N 1280129E
10. 360906N 1280129E

Simchon to Hwanggan

1. 361004N 1280046E
2. 361012N 1280045E
3. 361020N 1280049E
4. 361033N 1280047E
5. 361036N 1280023E
6. 361049N 1280027E

7. 361105N 1280001E
8. 361155N 1280016E
9. 361213N 1280016E
10. 361239N 1275958E
11. 361255N 1275935E
12. 361300N 1275937E
13. 361303N 1275921E
14. 361250N 1275801E
15. 361254N 1275759E - Figure 8
16. 361244N 1275745E
17. 361241N 1275719E
18. 361306N 1275619E
19. 361308N 1275611E
20. 361311N 1275535E
21. 361330N 1275457E
22. 361335N 1275438E
23. 361331N 1275426E

Hwanggan to Yongdong

1. 361336N 1275404E
2. 361315N 1275315E
3. 361306N 1275256E

4. 361258N 1275259E - Figures 7 and 18
5. 361257N 1275250E - Figure 10 - No Gun-Ri Railroad Bridge
6. 361256N 1275253E - Figure 10 - No Gun-Ri Road Bridge
7. 361253N 1275251E
8. 361212N 1275219E
9. 361205N 1275212E
10. 361125N 1275116E
11. 361100N 1275033E
12. 361051N 1275036E
13. 361005N 1274853E
14. 361010N 1274813E
15. 361026N 1274801E
16. 361013N 1274801E

Appendix 2

Analyst Comments

1. Other than hearing a few news reports about the No Gun-Ri incident, the imagery analyst did not know the details of any of the allegations being made in the press. When tasked with this project, other than locating the area on a map and having a US Army National Ground Intelligence Center analyst point out the No Gun-Ri bridge on the 6 August 1950 imagery, the analyst made no attempt to familiarize himself with the stories surrounding this case. The analyst was not provided (nor did he request) any background materials from the US Army IG office.
2. Analytical assessments, while made in a vacuum about the details of the events of the target area, were not made without the review of other NIMA imagery analysts. Six analysts, with varying degrees and types of analytical experience, were asked to view suspect areas and state their opinions -- in all cases probable strafing was the opinion expressed.
3. Since no available imagery covered the timeframe between the claimed incident date of 26 July 1950⁹ and the 6 August 1950 imagery examined for this study, no analytical method or technique can be used to determine when the probable strafings occurred. If information was available about environmental conditions at No Gun-Ri in late July and August of 1950, then it might be possible to estimate when the probable strafing occurred. But absent that environmental information, all that can accurately be said is that the probable strafing occurred before the images were taken on 6 August 1950.
4. Analysis is best performed on imagery as close to the original negative (ON) as possible. With each successive reproduction (or generation) there is a loss of quality. Depending on the quality of the ON, features that can be viewed in a second generation DUPPOS may be totally indistinguishable by the fourth to sixth generation. (Explanation of film generations - the original negative, also called the mission negative, is the first generation, a DUPPOS made from that ON is the second generation, a DUPNEG made from the first DUPPOS is the third generation and the DUPPOS made from the DUPNEG is the fourth generation. Generally odd numbered generations are Negatives, while even numbered generations are Positives.)
5. **Use of film vs. digitized imagery for analysis** - There is an ongoing debate about using digitized historic imagery for analysis. It is the opinion of the imagery analyst, who accomplished the No Gun-Ri research, that using the digitized media opens the analysis to charges of altering the image. The problems with using digitized historic imagery begins with the actual digitization process. To avoid "saturation" the technician may adjust the process to "tone down" "bright" areas, this tone adjustment may result in the loss of details in "darker" areas of the image. When the digitized historic material is brought up on a computer screen for

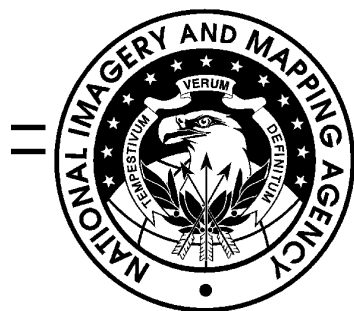
⁹ It was the understanding of the imagery analyst that the alleged No Gun-Ri incident is reported to have occurred at sometime between 26 and 29 July 1950.

viewing (or analysis) to "enhance" the image, gray tones can be altered or adjusted to "bring out" features the analyst is interested in viewing. This altering of the gray tones may cause the analyst to miss something or read into the scene something that was not on the basic filmed image. "Cleaning up" or digitally removing scratches, chemical spots, or dust that were on the basic film could result in covering or further altering features that might be important to the overall analysis. For this report, digitized historic imagery was used only for creating graphic; analysis was based on a fourth generation DUPPOS of the historic film.

Appendix C

Tab 2

NMA Imagery Analysis Review and Comments on the Republic of Korea's No
Gun-Ri Investigation Team's "Analysis on Overhead Imagery" (Date of Imagery
06 August 1950)



Imagery
Analysis

NIMA Imagery Analysis
Review and Comments
on the Republic of Korea's
No Gun-Ri Investigation Team's
"Analysis on Overhead Imagery"
(Date of Imagery 06 August 1950)

I. INTRODUCTION

1. The National Imagery and Mapping Agency (NIMA) was formally requested by the US Army Inspectors General Office to review and comment on issues addressed in the Republic of Korea's No Gun-Ri Investigation Team's "Analysis on Overhead Imagary" (sic) (prepared by the Image Analysis Team, Aerial IMINT Squadron, 39th Tactical Reconnaissance Group, Republic of Korea). Specifically NIMA was requested to:

- a. Determine if the items addressed in the report are accurate.
- b. Comment on the doctrine and procedures used by the USAF during 1950 to "index" aerial reconnaissance missions.
- c. Assess terrain conditions, as impacted by weather, that can be ascertained from analysis of images over the No Gun-Ri area.
- d. Comment on the anomaly between frames 34 and 35 identified as "mislabeled" in the report.

2. The text of the Republic of Korea's No Gun-Ri Investigation Team's "Analysis on Overhead Imagary" (sic) has been reproduced **exactly** and indicated by italicized print within the text of this report (Appendix A is a ROK government document and will not be reproduced for the final report. Requests for release of this document should be submitted to the Korean government), while the NIMA imagery analyst's findings and comments are in regular print. Most of the Korean Image Analysis Team (KIAT) comments concern the imagery frames in the vicinity of the No Gun-Ri railroad bridge (Figure 1).

II. DOCTRINE AND PROCEDURES OF THE US AIR FORCE IN 1950

1. NIMA IA could not determine the specific unit doctrines and procedures that were in use by the 8th Tactical Reconnaissance Squadron (8 TRS) of the US Fifth Air Force in August 1950. While a copy of the unit Standard Operating Procedures (SOP) manual would have been the best source of this information, no such document was located or provided to NIMA. Without the SOP, NIMA IA determined that a review of US Air Force regulations and technical manuals of the era would provide indications of the requirements and procedures that would have served as the basis for the unit developed SOP.

2. NIMA IA reviewed a copy of TM 30-245/NAVAIR 10-35-685/AFM 200-50, Image Interpretation Handbook, dated December 1967, which superseded the 1954 editions of the publication, TM 30-245/NAVAER 10-35-610/AFM 200-50, Photographic Interpretation Handbook, dated 1 April 1954. A review of the section on plotting in the 1954 publication referenced Air Force Regulation 95-7, for detailed requirements for plotting and imagery titling.

3. NIMA IA requested copies of any Air Force regulations or technical manuals that would have been in effect in August 1950 that concerned plotting and indexing of aerial photography. Researchers at the National Archives located and provided copies of Army Air Force Regulation (AAFR) 95-7, PHOTOGRAPHY, MAPS AND CHARTS, Titling and Identification of AAF Still Photographic Negatives, dated 18 July 1946; Air Force Regulation 95-18, PHOTOGRAPHY, USAF Standard Plotting System for Aerial and Radar Scope Photography, dated 30 June 1954; and Air Force Regulation 95-7, PHOTOGRAPHY, Titling, Identification and Disposition of USAF Aerial Photographic Negatives, dated 01 April 1958. While none of the referenced regulations were specifically in effect in August 1950, statements common to the regulations and the 1954 technical manual suggests that certain requirements were carried forward in the intermediate editions. Specific applicable statements from the referenced regulations and technical manuals have been extracted and included as Appendix B.

4. Titling data on the various frames of the 06 August 1950 imagery and the preparation of the field plot used as the leader frame (called the *INDEX* by the KIAT and here after in this document to avoid confusion) were in accordance with procedures and requirements noted in the referenced regulations and technical manuals that were in effect prior to and after 06 August 1950.

III. IMAGERY INFORMATION

1. **0 Date & Time:** 1950. 8. 6, 14:00 - 14:30 -- Titling data on the various film frames and the index, indicated a date of "6 Aug 50"; a probable time over target of 1400 was annotated on frame 1 and a time of 1430 was annotated on frame 86 (various intermediate times were annotated on frames within the mission). Evaluation of shadows caused by various objects on the imagery indicated a midday to early afternoon imaging time.

2. **0 Area:** *Area along the railroad and Rt. 4, YD~HG, ChoongBuk* -- Actual coverage on the mission was from Sinam-Ni to an area west of Yongdong,¹ more so along the road than the railroad (in areas where the railroad became widely separated from the road, the road was followed).
3. **0 Unit:** *5 AF 8 TRS (Yokota, JAPAN)* -- Concur on unit identification, per annotations on the imagery. As to unit location, there was nothing on the imagery to indicate the unit location.
4. **0 Type of AC / Mission No.:** *RF-80A, R-337A* -- Concur on Mission Number, however there was nothing on the imagery to indicate aircraft type.
5. **0 Type of Photo:** *Continuous/Perpendicular photo with neg. copy film* -- Concur, there were 86 continuous frames of vertical imagery taken with an unknown model of framing camera using a 9 inch x 9 inch film format. NIMA/IA was told by Defense Intelligence Agency (DIA) photo lab personnel that a third generation Duplicate Negative had been provided to the KIAT.
6. **0 Altitude:** *3,500ft* -- Concur, as that is the information annotated on the film index.²

IV. FACTORS FOR ANALYSIS

1. The KIAT report listed the following *Factors for Analysis*:
 - 0 Targets for identification:** *Unit Facilities, positions, patterns, indication of possible maneuver by vehicles and/or military forces*
 - 0 Non military targets :** *roads, bridges, railroad, stream, crops, etc.*
 - 0 Factors consistent with operational situation and interview results**
 - 0 Outer portion of each part of the film that joints adjacent ones**
2. The KIAT factors for analysis were consistent with the original NIMA tasking to provide an analysis of two aerial reconnaissance missions, dated 06 August 1950 and 19 September 1950, with two exceptions:
 - a. NIMA was not provided information about the "*operational situation or interview results.*"
 - b. NIMA was not initially tasked to examine the "*outer portion of each part of the film that joints adjacent ones.*"

¹ Place name spellings from current KAMC Map Series L754, Sheet Number 3318 III, Sheet Name HWANGGAN, Scale 1:50,000.

² AAFR 95-7 specified that the "average altitude of the various flight lines" be recorded.

3. During the original study, evidence of splicing or cuts, was noted in the interspace between several frames on the Duplicate Positive (DUPPOS) from which the NIMA imagery analyst (IA) conducted his analysis. The NIMA IA contacted DIA photo lab personnel who told him that the Original Negative (ON) was intact, except for some torn frames, but there were no splices between any frames on the ON. The NIMA IA was then told that working copies of the film were made from a third generation Duplicate Negative (DUPNEG).

4. In support of the current tasking, the NIMA IA visited the DIA Photo Lab with the US Army Inspectors General Investigator and reviewed both the ON and the DUPNEG that DIA was using. The results of this examination will be discussed in detail in Section IV. B. **Film Analysis.**

V. RESULTS

A. Photo Analysis

1. - *Manifold unrecovered patterns identified at the area of YD ~ HG* -- NIMA IA understood this to mean that there were multiple unrecovered similar holes found on the imagery between Yongdong (YD) and Hwanggan (HG) -- which is to say that the KIAT probably located and noted several areas of open foxholes or fighting positions. NIMA IA was in agreement; several grouped foxholes/fighting positions were imaged throughout the coverage and all were open (meaning not filled in or recovered). However, several were showing signs of collapse consistent with the effects of local weather conditions and time (Figure 2).

2. - *Some destroyed town bldgs next to the road b/w YD ~ HG* -- NIMA IA was again in agreement; several buildings in the local towns/villages covered on the imagery showed the effects of damage and destruction by various types of munitions.

3. - *No indication of vehicle or forces maneuver nor AA of units at the area along RR and Rt 4* -- Again NIMA IA was in agreement; vehicle tracks and foxholes were noted throughout the imaged area, but we saw nothing to indicate that military forces were active or present at the time of the imaging.

4. - *Object possibly used for MG mount located at 50-70 meters north of the tunnels* -- What the KIAT referred to as "*tunnels*," were the two water underpasses or arches under the railroad bridge. As to the direction "*north*", the KIAT seemed to be referring to the downstream side of the bridges.³ NIMA IA drew an arc (using the center support of the railroad bridge) approximately 70 meters from the support to define the area of interest; several craters were located within this area, all of which gave the appearance of munitions craters rather than fighting positions (or a machine gun (MG) mount) (Figure 3).

5. - *Two unidentified objects located at 10m north of the tunnels* - On the downstream side of the railroad bridge (again in the general direction of north per the KIAT), at approximately 6 meters west of the southern-most bridge arch and then at about 10 meters west of the northern-most bridge arch, was a

³ The stream that the No Gun-Ri railroad bridge crosses flows generally south to north; at the bridges the streambed curves to the west so that the flow under the bridge is more east to west.

possible footbridge -- a linear feature that ran on a diagonal from the southern bank of the stream to the northern bank of the stream. When viewed in stereo and under magnification, there appeared to be some minor height above the water surface and small spaces between the objects that formed this feature, suggesting that it was comprised of rocks (Figure 4). This feature, extending across the stream as it did, would have acted as a barrier, catching debris that would have washed downstream, though no debris was visible here on the 06 August 1950 imagery.

6. - *Many craters due to air strike and ground fire identified* -- Craters from various types of munitions (probably aerial bombs, rockets, mortars, and artillery) appeared throughout the frames of the 6 August 1950 imagery.

7. - *Foot bridge at 8m south of the tunnels identified in the shape of " V "* -- The identified "foot bridge" was a build up of sand at the base of the railroad bridge on the upstream side. Foot traffic could have used the sandbar to cross the stream bed, but it is doubtful that it was a man-made feature (Figure 5).

8. - *Artificial patterns located at 200m southwest of the tunnels near RR (Estimated not due to air strike)* -- NIMA IA had previously identified this as the probable northeastern strafed area (Figure 6).

9. - *Bridge and two vehicles destroyed identified at 250m northeast of the tunnels* -- This is one of two bridges identified as destroyed/damaged in the original NIMA analysis. There were two possible vehicles in the immediate area, but the vehicle status and type (though the vehicles were probably wheeled, vice tracked, based on an approximate 3:1 length to width ratio⁴) is unknown (Figure 7).

10. - *No corpse or other objects on the railroad* -- NIMA IA found no indications of human remains on the imagery. Of particular interest was the area of the railroad bridge; the obliquity of frames 32, 33, and 35 allowed the IA to look approximately 3 meters into the openings of the bridge arches on the upstream side and the area was found to be clear of debris or human remains (Figure 8).

B. Film Analysis

1. - *Composed of total parts of negative film (INDEX 1, Continuous 86)* -- The 06 August 1950 film was composed of 87 frames; one index frame and 86 frames of imagery.

2. - *Indication no. on the INDEX seldom matched those on the CONTINUOUS (as you may understand, INDEX is a map with **accurate** assessment of the continuous parts of films, for example, showing the dimensions of captured area)*

a. The index (Figure 9), in this case, was a photograph of a section of a 1:250,000 scale map, with a line drawn to represent the **approximate** flight path of the mission aircraft and squares drawn to

⁴ A standard imagery interpretation method used to distinguish between tracked and wheeled vehicles is to determine the length to width ratio. Tracked vehicles tend to have 2:1 ratios, while wheeled vehicles generally are 3:1 or greater.

indicate the **approximate** coverage of some of the frames of imagery found in the mission.⁵ The KIAT statement indicates that they believed that for the index to be correct, the boxes drawn to represent the coverage of a particular frame had to be exact (possibly surveyed) points. In actuality, the degree of accuracy of the coverage box is dependant on numerous factors - not the least of which is the skill level of the analyst who drew the trace,⁶ the technique used to draw the coverage boxes (freehand or template), variations in the aircraft altitude (resulting in some scale variation), and the scale of the base map being used (a plot drawn on a 1:50,000 scale map would be more accurate than one drawn on a 1:250,000 scale map).

b. On the 06 August 1950 imagery, the coverage boxes were uniform in size, indicating that a device such as a plotting template (Figure 10), as specified in the referenced regulations and technical manuals was probably used to draw the boxes that represented the image frame coverage. Because the size of a template drawn box was determined using the **average altitude** for the flight line,⁷ it was by definition, an imprecise representation of the coverage box.

3. - *Found that many portions of film seemed to be cut and rejoined (INDEX 1, CONTINUOUS No. 29-35)* -- It would have been strange if the index wasn't spliced into the roll, considering that an analyst would have to refer to the base imagery to draw the index. The process followed was: the mission was flown, film developed, imagery analyzed, and reports written and disseminated; at some later time the index map was drawn up, photographed, and then spliced into the roll of film.⁸

4. - *Shadows identified only on the side of film No. 29 to 35* -- The shadows that were referenced in this statement and the "*cut and rejoined*" statement in the preceding paragraph referred to the cut lines and tape shadows seen in the interspace between frames 29-35 that appeared in the DUPNEG provided to the KIAT. The Korean team was correct, in that those frames showed evidence of cutting and splicing (shadow of the tape used to rejoin the frames and an irregular line -- probably cut with scissors -- between the frames). However, on the ON in the possession of DIA no such cuts or splices existed. This indicates that at some time a DUPPOS was made from the ON, frames were cut from that DUPPOS (possibly for ease of viewing the frames in stereo), spliced back into the roll and then the DUPPOS was sent back to the photo lab to generate a DUPNEG and additional DUPPOS copies. NIMA IA compared

⁵ This description is what AAFR 95-7 identified as a "Field Plot", see Appendix B.

⁶ It has been the experience of this analyst that different analysts plotting the borders of the same frame of imagery will in all likelihood produce different plots - the main features of the image will be within the plotted box, but the exact boundaries of the borders will differ.

⁷ The standard formula for calculating the size of the square used to represent an individual coverage box is:
Template size (in inches) = $\frac{\text{Image length (inches)} \times \text{Image scale reciprocal}}{\text{Map Scale Reciprocal}}$ or in this case $\frac{9 \text{ (inches)} \times 7000}{250000} = .252 \text{ inches}$
If a plotting template was used, the plot would not be 100% accurate in ground coverage, rather it would approximate the ground coverage of the indicated frames.

⁸ As specified in AAFR 95-7 and AFR 95-18, see Appendix B.

the ON to the DIA DUPNEG (that is of the same generation as the KIAT DUPNEG); all frames on the DUPNEG were exact duplicates of the frames on the ON. Additional details on NIMA IA's comparison is provided in paragraphs a-c below:

a. NIMA IA verified that the ON consisted of 86 continuous unspliced frames of imagery with a film leader containing mission and coverage data (index frame) spliced into the roll. At some point in time, damage to the Original Negative had occurred; tears -- repaired with transparent tape -- were found on frames 41, 51, 52, 53, 58 and 59. The film was somewhat brittle; the tears probably occurred during some previous reproduction process, though the repairs with transparent tape appeared to be recent (tape was unyellowed and flexible).

b. The DUPNEG was then compared by NIMA IA frame by frame to the ON. Images of cuts and the shadows of tape were noted between frames 28-29, 29-30, 30-31, 31-32, 32-33, 33-34, 34-35 indicating that a second generation DUPPOS had been cut and spliced back together before a third generation DUPNEG was produced (Figure 11 depicts both uncut frames interspace and spliced frames interspace). However, the content and order of all the frames of the DUPNEG matched exactly the frames of the ON. Shadows of the tears and taped repairs appeared on frames 41, 51, 52, 53, 58 and 59 of the DUPNEG.

c. Based on lab orders stored with the film and conversations with photo lab personnel from DIA, the following scenario developed. It appeared that a DUPPOS was produced from the ON for use in the No Gun-Ri investigation. The ON had been torn (when the ON was torn could not be determined, but it was before the second generation DUPPOS was produced; most of the tape covering the tears appeared relatively new (unyellowed) and flexible indicating that the tears and repairs were recent). The DUPPOS was used for the initial analytical work (conducted by the US Army National Ground Intelligence Center (NGIC)), during which the NGIC analyst probably cut several frames (frames 29-34) from the roll. At a later date, additional copies of the entire mission were required, but a decision was made that further use of the ON for reproduction carried a high risk of additional damage or destruction. To prevent further damage to the ON the NGIC analyst was asked to return the DUPPOS to the lab so that a DUPNEG could be generated. The analyst taped the frames back into the roll, in the proper order and sent the film back to the lab for reproduction. The resulting DUPNEG contained evidence of the tears and repairs on the ON and splices made on the DUPPOS.

5. - *CONTINUOUS No. 34 & 35 mislabeled each other* --Frames 34 and 35 were not mislabeled, as discussed above there was no indications of cuts in the ON, and a comparison of frames 34 and 35 between the ON and the DUPNEG showed that the DUPNEG was an exact duplication.

a. What was not indicated on the index, but should have been indicated on the pilots mission debriefing (if a record copy of it still exists) was that there were actually two separate flight lines. It appeared that the pilot turned the camera off after taking frame 34, circled, realigned his flight path, and turned the camera system back on for frames 35-86.

b. This was determined by using two methods:

(1). First, by overlapping frames 32, 33, and 34 (aligning common points on the frames), a progressive overlap in coverage of approximately 50 percent per frame was evident. However, frame 35, instead of overlapping 50 percent of frame 34, provided an area of coverage that was approximately 50 percent of frame 33 and 50 percent of frame 34, and the flight line had turned approximately 30° to the southeast. (Figure 12)

(2). The second method was by viewing the imagery in stereo.⁹ Common points were aligned and could be viewed in stereo on frames 32 and 33 and frames 33 and 34. But when frames 34 and 35 were placed in order (frame 34 on the left, frame 35 on the right), the stereo "reversed", meaning that objects that were inverted instead showed height. In an expected imaging sequence, the nadir¹⁰ of each successive frame will be to the right of the nadir of the frame preceding it. The progression of the nadir together with frame overlap allows the imagery analyst to view images in stereo; if the images are in the proper sequence then the analyst will perceive height and depth in their proper locations. Because nadir on frame 35 is to the "left" of frame 34, viewing the images in sequence (frame 34 on the left, frame 35 on the right) results in a perception of height where depth should be. The lack of evidence of a cut and splice in the interspace between frames 34 and 35 indicates that a second flight line caused that stereo reversal rather than the images being improperly resequenced or coming from another, separate reconnaissance mission.

6. - *Handwriting on outer portion of INDEX is different from those of others* -- Without knowing what the unit procedures of the 5th AF, 8th TRS were in 1950, it would be impossible to know exactly how many personnel may have been involved in the handling of the 06 August 1950 imagery. It was conceivable that several different personnel were involved in the film development, imagery analysis, individual frame labeling and the production of the index. As previously discussed in paragraph IV.B.3. above, there was no accurate way of determining when the index frame was added.

7. - *Waters in YD ~ HG area are high, yellow, and run fast whereas those in NGR are low, blue, and stay* Rainfall for the area on 1,2,5,6 of Aug 1950 according to records (HQ, 5AF APO 970, Final Recap - Summary of Air Ops, Period 0000K - 2400K, 1-6 Aug 50)

a. NIMA IA felt that the KIAT was indicating that the streams in the No Gun-Ri (NGR) area were intermittent, seasonal streams that only contained water during periods of rain and that the 5th Air Force Final Recapitulation reports showed that there had been rain in the No Gun-Ri area on 01, 02, 05, and 06 August 1950.

b. On the 06 August 1950 imagery, there did not appear to be much, if any, movement of the water in the vicinity of the No Gun-Ri railroad bridge. Water appeared to be present on both the upstream and downstream sides of the bridge and wide sandbars were evident in the streambed.

⁹ In stereo viewing the left hand image is a picture of the left side of an object, while the right hand image is a picture of the right side of an object -- viewing both images simultaneously through special optics results in a three-dimensional effect.

¹⁰ Nadir is the point directly (vertically) beneath the aircraft -- usually the center point of a vertical image.

c. A review of the referenced Headquarters, 5th Air Force, Summaries of Air Operations (Appendix B), weather information did indicate rain on 01, 02, 05, and 06 August 1950.¹¹ However, the weather references appeared to be generic for the theater of operations and not for specific points within the theater. If there was rainfall in the No Gun-Ri area and the area of the various feeder streams, then the stream flow was only minimally affected; buildups of sand appear to block the streambed at several points along the upstream side of the bridges. Other stream beds in the immediate area were examined on the imagery, all appeared dry, indicating a lack of standing or running water. At the time of imaging, the sky was probably clear; no cloud shadows were noted on any of the frames of the 06 August 1950 imagery.

VI. TENTATIVE ASSESSMENT

1. *Some objects were identifiable notwithstanding the low resolution of the film. The photo was estimated to be taken for the time frame when there were neither ground forces nor vehicles activities present between YD ~ HG. Manifold patterns as well as evidences showing force maneuvers were identified.*

a. From the index frame, it was determined that the mission camera had a focal length of 152mm (6 inches) and was flown at an altitude of 3500 feet. The scale of the resulting imagery was calculated by NIMA IA at 1:7000;¹² resolution¹³ was such that individual railroad ties could be distinguished under magnification. A subjective classification of the film resolution as low was made by the KIAT, yet the KIAT seemed to be equating resolution with image quality and by extension interpretability. Currently imagery is classified in terms of interpretability using the National Imagery Interpretability Rating Scale (NIIRS).¹⁴ In the case of the 06 August 1950 imagery, the ability of the IA to distinguish individual railroad ties -- even on a fourth generation DUPPOS -- indicated that at a

¹¹ NIMA IA requested and received copies of the referenced documents, extracted weather information has been reproduced as Appendix C. A review of the documents indicated that air operations were not seriously hampered or affected by the weather, there were several specific references to airstrikes occurring in the Hwanggan and Yongdong area during the period 01-06 August 1950.

¹² Scale was determined using the following formulas: Photo Scale Reciprocal (PSR) = Altitude (height) in Feet times 12 divided by focal length in inches (F) or $\frac{H \times 12}{F} = \text{PSR}$; Scale (S) = 1 divided by PSR or $S = \frac{1}{\text{PSR}}$ (or it can be expressed as $S = 1 : \text{PSR}$).

¹³ Resolution is the ability of an entire photographic system, including lens, exposure, processing, and other factors, to render a sharply defined image. Objectively, resolution is expressed in terms of lines per millimeter recorded by a particular film under specified conditions.

¹⁴ While NIIRS ratings are subjective in nature, they are based on the ability an imagery analyst to distinguish certain objects on the imagery. Resolution (a mathematical expression, as defined in footnote 12), is a factor in a NIIRS determination, as is image quality (as defined by an imagery analyst), but the final rating is a numerical expression for the imagery's information potential for intelligence purpose or interpretability. A NIIRS rating of 7 was assigned to the 06 August 1950 imagery.

minimum, the film was classified as excellent for interpretability, and as such had either ground forces or human remains been imaged, they would have been discernible.

b. On the 06 August 1950 imagery there were no active ground forces visible in the No Gun-Ri area. Two possible unidentified vehicle (operational status unknown) were noted approximately 250 meters northeast of the No Gun-Ri bridges in the vicinity of a destroyed road bridge. Numerous vehicle tracks and individual fighting positions (foxholes) were seen in the area.

2. *It is doubtful that the INDEX and CONTINUOUS are from one identical film because INDEX doesn't match CONTINUOUS accordingly, and it found that outer portions of many parts seemed to have been cut and rejoined. It is regarded that these does not originated from a single role of films because only the films No. 29 to 35 have shadows on the side.*

a. The KIAT position was that the index is required to be an exact representation of the flight path and specific area of coverage of frames annotated along the flight path, when in actuality the index was nothing more than a general representation of both the flight path and area of coverage.

b. Several of the frames on the DUPNEG provided to the KIAT probably did show evidence of cutting and splicing (rejoining), particularly frames 29 to 35. But the determination of whether the referenced frames are from a single roll of imagery or not, comes not from the DUPNEG in the possession of the KIAT, but from the ON in the possession of DIA. The Original Negative is 86 continuous **uncut** frames of imagery. Comparison of the Original Negative and the DUPNEG in the possession of DIA (that DUPNEG was the same generation as the KIAT DUPNEG) indicates that the frames are exact copies; **no frames from another mission were spliced into either the ON or the DIA DUPNEG.**

3. *Therefore it is deemed inappropriate to adopt the imagery dated 8 Aug 1950 (sic) as a reference for cross-examination with the victims accounts. Please review and check whether relevant films were mistakenly not provided.*

a. The 06 August 1950 coverage is the earliest known and located imagery of the No Gun-Ri area post-incident (presuming an incident date of from 26 to 29 July 1950).

b. The DUPNEG provided to KIAT was the same generation as the DUPNEG in the possession of DIA, which has been verified as an exact duplicate of the ON.

VII. NIMA Conclusions

1. The Original Negative of the 5th Air Force, 8th Tactical Reconnaissance Squadrons, Mission Number R-337A, flown on 06 August 1950 (in the possession of the Defense Intelligence Agency) contains 86 continuous, uncut frames of imagery and an index frame containing a field plot spliced onto the beginning of the mission. The individual frame markings and the field plot were consistent with the requirements found in an Army Air Force Regulation dated 1946 and Air Force Regulations dated 1954 and 1958.

2. The *INDEX* is a field plot that is **sufficiently accurate** to provide imagery analysts reviewing the imagery a guide to the area covered. It is not an exact plot of the indicated frames precise ground coverage. The uniformity of size for the coverage boxes along the flight line indicates that a template was used in producing the index.
3. That the index frame and individual frame identification data appeared to have been prepared in accordance with the standards of regulations that were dated in 1946, 1954, and 1958, and technical manuals dated 1954, suggests that the 1950 regulations and procedures would have followed these same standards.
4. The imagery covered an area that had been the site of military action -- munitions (aerial bombs, rockets, mortars, and artillery) craters were seen throughout the images. Several areas of fighting positions (foxholes) were located. Vehicle tracks were noted around the imaged countryside. Several buildings within the villages/towns imaged had been damaged or destroyed. No active forces (personnel or equipment) were imaged. Two possible wheeled vehicles were seen in the vicinity of a destroyed bridge, but their operational status could not be determined.
5. A second generation DUPPOS was produced from the ON by the DIA photo lab for the initial No Gun-Ri investigation. Several frames from the DUPPOS had been cut from the roll of imagery and then taped back into the roll in the proper sequence. Images of the cuts and tape on several frames between frames 29 and 35 were visible on the subsequent third generation DUPNEG and fourth generation DUPPOS.
6. The previously discussed cuts and splices notwithstanding, a comparison of the DUPNEG with the ON, particularly frames 29, 30, 31, 32, 33, 34, and 35, indicates that the DUPNEG that DIA was using to make copies was accurate and complete. All frames matched up -- in order and in content -- between the ON and the DUPNEG.
7. At least two flight lines are represented in the ON and DUPNEG; frames 1-34 comprised one flight line, while frames 35-86 made up the second flight line. This was most evident by the areas overlapped by frames 33 and 34 when they are overlaid by frame 35.
8. Streams in the No Gun-Ri area were examined and many appeared dry. The lack of standing or running water in the streambed would indicate that either there was little to no rainfall in the immediate area in the days preceding the imaging (unless the soil making up those stream beds was extremely dry and absorbent, or the area experienced a very fast run off). Furthermore, the vehicle tracks in the sand of the streambed between the No Gun-Ri railroad and road bridges would indicate that there had been no high, fast moving water immediately before the area was imaged.
9. The stream crossed by the No Gun-Ri railroad bridge did have standing water on both the upstream and downstream sides, however, sandbars were noted along the imaged length of the stream and a buildup of sand forming a "V" shape on the upstream side at the base of the bridge. The sand buildup could have been used as a footbridge across the stream. A possible footbridge made of rocks on

the downstream side of the No Gun-Ri railroad bridge would have acted as a dam, catching debris had it been washed downstream.

10. Because the imagery was of sufficient quality and resolution to discern individual railroad ties along the railbed, it should also be sufficient to detect human remains had they been present at imaging. There were no indications of human remains along the roads, railroad, bridges or streambeds in the No Gun-Ri area on the 06 August 1950 imagery.

VIII. NIMA Recommendations. In any future studies using historic imagery, NIMA/IA recommends that the following procedures be utilized:

1. After locating the film in whatever archives in which it is stored, two DUPPOS copies and at least one DUPNEG should be generated from the ON.
2. A certification process/procedure should be developed that can be used to certify that the resulting copies are exact duplicates of the ON.
3. One DUPPOS copy and the DUPNEG should be designated as the official record copies stored for future reproduction needs. Future copies not should be from the ON so that additional damage does not occur.
4. Analysts should be notified in advance when they receive copies of imagery made from the official record copies and that the copy generation should be stipulated.
5. Upon completion of the study, the ON and the designated official record copies should be returned to the archives with whatever documentation is necessary to preserve the ON and preclude its future reproduction.

Appendix A

"Analysis on Overhead Imagary" prepared by the Image Analysis Team, Aerial IMINT Squadron, 39th Tactical Reconnaissance Group (TRG), Republic of Korea (ROK)

NOTE: Appendix A is a Republic of Korea document and will not be reproduced for the final report. Requests for release of this document should be submitted to the Korean government.

Appendix B

Extracted Statements from 1946, 1954, and 1958 Regulations and 1956 Technical Manuals

1. Army Air Force Regulation 95-7, PHOTOGRAPHY, MAPS, AND CHARTS, Titling and identification of AAF Still Photographic Negatives, dated 18 July 1946.

Section IV PLOT MAPS AND PHOTO INDICES

Paragraph 12.a. Field Plot. A field plot will be prepared, on a map 1:250,000 scale, immediately after each flight. Where such a map series does not exist, the 1:1,000,000 aeronautical chart will be used. For small island areas a map larger than 1:250,000 scale will be used when necessary in the interests of clarity and completeness of detail. Approximately each fifth photograph will be plotted by use of a template; these will be connected by a flight line. A photographic negative of this plot equal in width to the width of the original film, will be prepared and stripped on to the original roll of film to precede exposure No. 1 for the flight. A print of this plot will accompany each set of prints or duplicate negatives.

2. Air Force Regulation 95-18, PHOTOGRAPHY, USAF Standard Plotting System for Aerial and Radar Scope Photography, dated 30 June 1954.

1. Purpose and Scope. This regulation establishes a standardized procedure for plotting and transmitting film and information on both aerial and radar scope photography. It applies to all Air Force activities engaged in the accomplishment of aerial photography except motion picture photography.

2. Policy:

a. To gain maximum return from the Air Force aerial photographic effort and to improve the Air Force ability to utilize all accomplished photography, the USAF Standard Plotting System for index Air Force photography, as described herein, will be used.

c. During combat conditions total compliance with the provisions of this Regulation may unduly burden the facilities of a unit or units. Under these conditions, commanders of major air commands may exempt certain reconnaissance photography of specific areas which are subject to excessive repetitious cover. However when these conditions exist, coverage which indicates significant intelligence changes will be processed in accordance with this Regulation.

3. Procedure:

a. Aerial photography will be plotted to the USAF Standard Plotting System.

Attachment 1 to AFR 95-18, USAF STANDARD PLOTTING SYSTEM FOR AERIAL PHOTOGRAPHY

1. GENERAL:

a. In order to record, orient, and locate aerial photography with respect to the actual ground photographed, a plot will be prepared on all types of aerial photography.

b. Photography will be plotted to a Standard Plotting scale of 1:250,000 and final inking of plots will be accomplished on 20" x 22" transparent acetate sheets which will cover 1° or possibly 2° quadrangles of the base chart used.

c. USAF Aeronautical Approach Charts (scale of 1:250,000) will be used as base charts whenever possible.

d. After the acetate plot is completed, all field duplicating requirements will be accomplished and a copy negative of the acetate and map base reduced to the film width will be attached to the original roll.

2. PROCEDURES:

a. Aerial photography will be plotted by use of a template system, each template so adjusted that the chart detail falling within the template outline coincides with the topographic detail appearing in the photography. Template size must be verified, however, by visually comparing chart or map detail to the photograph, since the true altitude over terrain may be different than that indicated on the film.

d. Aerial photography will be separated into three main categories when plotting to the USAF Standard Plotting System:

(1) Mapping Photography:

(a) Mapping photography will be plotted starting with exposure number 1, and then plotting approximately each fifth consecutive exposure. If the plot of every fifth exposure would overlap, it is permissible to skip more exposures between plots.

(e) Each plotted exposure within a run will be connected by a flight line.

(3) Reconnaissance Photography

(a) Reconnaissance photography will be indexed in the same manner prescribed for mapping photography, with the following exceptions:

3. Sufficient exposures must be plotted to portray correctly all major changes of flight direction.

3. Air Force Regulation 95-7, PHOTOGRAPHY, Titling, Identification and Disposition of USAF Aerial Photographic Negatives, dated 1 April 1958.

Paragraph 9. Procedure for Preparing Plot Maps:

a. The organization accomplishing aerial mapping or charting photography will prepare plot maps of the actual ground areas photographed by the vertical camera to permanently record, orient, and locate the photography.

b. Photography will be plotted to a map or to an overlay of appropriate scale immediately after each flight. The map should be of a scale that allows complete plotting for each sortie or roll of film whichever is appropriate.

c. The first and the last photograph of each unbroken straight flight line will be plotted by use of a template. The plots will then be connected by a straight line.

d. Whenever a straight flight line is broken by camera malfunction or for any other reason, the last photograph before the break and the first photo after the break will be plotted.

e. Whenever a curved or crooked flight line is flown which deviated more than 3 degrees from a straight line drawn from the first to the last photo taken, every fifth photograph will be plotted for that portion of the flight line that deviates.

Paragraph 10. Preparing Index Plots. The organization accomplishing aerial photography will prepare index plots of all mapping, charting, and reconnaissance photography, including radarscope and radar image photography, as outlined in AFR 95-18.

4. Department of the Army Technical Manual TM 30-245 / Department of the Navy NAVAER 10-35-610 / Department of the Air Force Manual AFM 200-50, Photographic Interpretation Handbook, dated 1 April 1954.

Section V. Plotting

Paragraph 30501. The plot of an aerial photograph is the permanent record on a map (or overlay keyed to a map) of the area covered by the photograph. Plot maps are essential for rapid identification and location of aerial photographs. For this reason, service regulations require that the flying organization prepare plot maps on all aerial photography. Titling of negatives is required to insure proper identification and the availability of basic working information. Plotting and titling instructions for Army and Air Force are contained in AFR 95-7; for the Navy in OPNAV 3150.6.

Paragraph 30502.c. Reconnaissance photography is aerial photography of any camera focal length, used primarily for intelligence. Plot maps for reconnaissance photography, like those for mapping photography, are known as "field plots" and are prepared at a map scale of 1:250,000, unless a larger scale is necessary in the interest of clarity.

PREPARATION OF FIELD-PLOT TYPES

Paragraph 30510. The fundamental principle in preparing field plots is to show the precise position of enough frames (usually at least one out of five) to establish all characteristics of the flight line and to permit identification of individual prints showing any specific point. Army and Air Force personnel should consult AFR 95-7 for details of this type of plotting. While personnel preparing reconnaissance plots are not required to adhere to this regulation, it is desirable to follow a standard where possible.

PREPARATION OF PLOTS FOR ORIENTATION

Paragraph 30511. Where it is more important to show the relationship of various geographic features over relatively large areas than it is to give precise location of individual photos, time-saving short cuts may be taken in plotting.

GENERAL PLOTTING PROCEDURE

Equipment Required

Paragraph 30512. The basic equipment required is a plotting template, a suitable map, and a large, well-lighted work table. Particular care should be used to select a map of satisfactory scale and type.

Plotting Vertical Photographs

Paragraph 30514. The plotting template can be adjusted by eye to form a rectangle of the correct size if a relatively large-scale map with good detail is used. Otherwise the proper length of a side on the template may be obtained using the formula:

$$\text{Template size (inches)} = \frac{\text{Photo length (inches)} \times \text{Photo scale reciprocal}}{\text{Map scale reciprocal}}$$

For example, to determine the template size for plotting a 9" x 9" photo of scale 1/10,000 on a 1/250,000 map:

$$\text{Template size} = \frac{9 \times 10,000}{250,000} = 0.36 \text{ inch.}$$

Appendix C

Extracted Weather Assessment from 5th Air Force 1-6 August 1950

1. FINAL RECAPITULATION - SUMMARY OF AIR OPERATIONS PERIOD: 0001/K - 2400/K, 1 Aug 50

A. WEATHER

Rain with low cloud cover throughout the target area hampered operations during the day and night.

2. FINAL RECAPITULATION - SUMMARY OF AIR OPERATIONS PERIOD: 0001/K - 2400/K, 2 Aug 50

A. WEATHER

Low cloud cover with restricted visibilities in rain hampered operations throughout the day.

3. FINAL RECAPITULATION - SUMMARY OF AIR OPERATIONS PERIOD: 0001/K - 2400/K, 3 Aug 50

A. WEATHER

Visibilities restricted in fog and haze. Southeast coastal area until noon, remaining target scattered to broken low clouds, permitting operations to continue.

4. FINAL RECAPITULATION - SUMMARY OF AIR OPERATIONS PERIOD: 0001/K - 2400/K, 4 Aug 50

A. WEATHER

Thunderstorms and heavy rain in central area, remainder of target area broken low and middle clouds with good visibilities. Northern portion of target area were clear. Operations continued as planned.

5. FINAL RECAPITULATION - SUMMARY OF AIR OPERATIONS PERIOD: 0001/K - 2400/K, 5 Aug 50

A. WEATHER

Southern area scattered to broken low and middle clouds, visibilities good except occasionally restricted in haze. Operations continued as planned

6. FINAL RECAPITULATION - SUMMARY OF AIR OPERATIONS PERIOD: 0001/K - 2400/K, 6 Aug 50

A. WEATHER

Target area broken low and middle clouds, numerous thunderstorms and scattered rain showers, restricted operations throughout the day.

VICINITY NO GUN-RI, ROK
RAILROAD AND HIGHWAY BRIDGES
361257N1275250E 06AUG50



FIGURE 1



FIGURE 2



FIGURE 3



VICINITY NO GUN-RI, ROK
RAILROAD BRIDGE
361257N1275250E 06AUG50



POSSIBLE
FOOT BRIDGE

FIGURE 4



VICINITY NO GUN-RI, ROK
RAILROAD BRIDGE
361257N1275250E 06AUG50



SAND
DEPOSIT

FIGURE 5

VICINITY NO GUN-RI, ROK
PROBABLE NORTHEASTERN STRAFED AREA
361249N1275244E 06AUG50



FIGURE 6





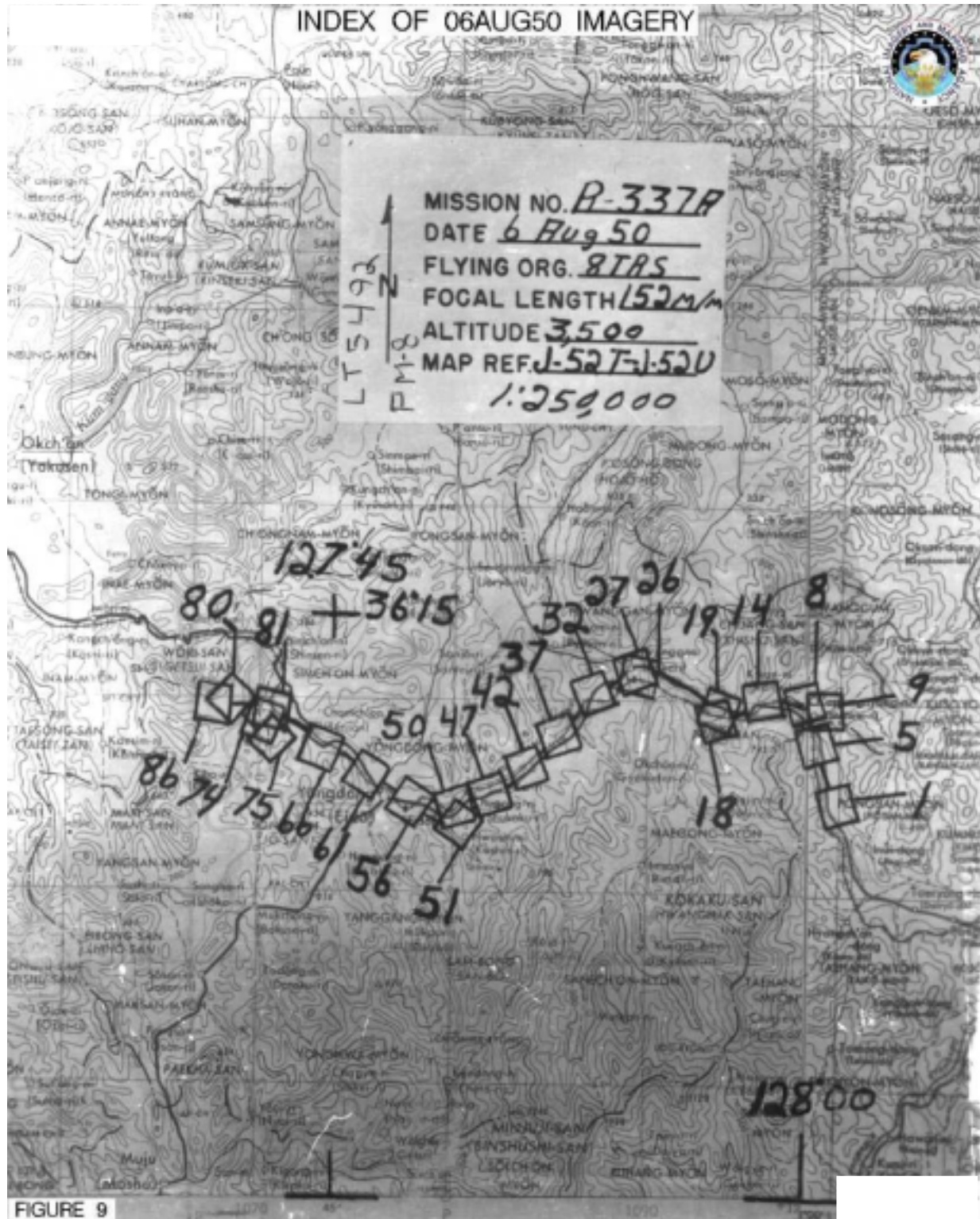


FIGURE 9

PLOTTING TEMPLATE EXAMPLE

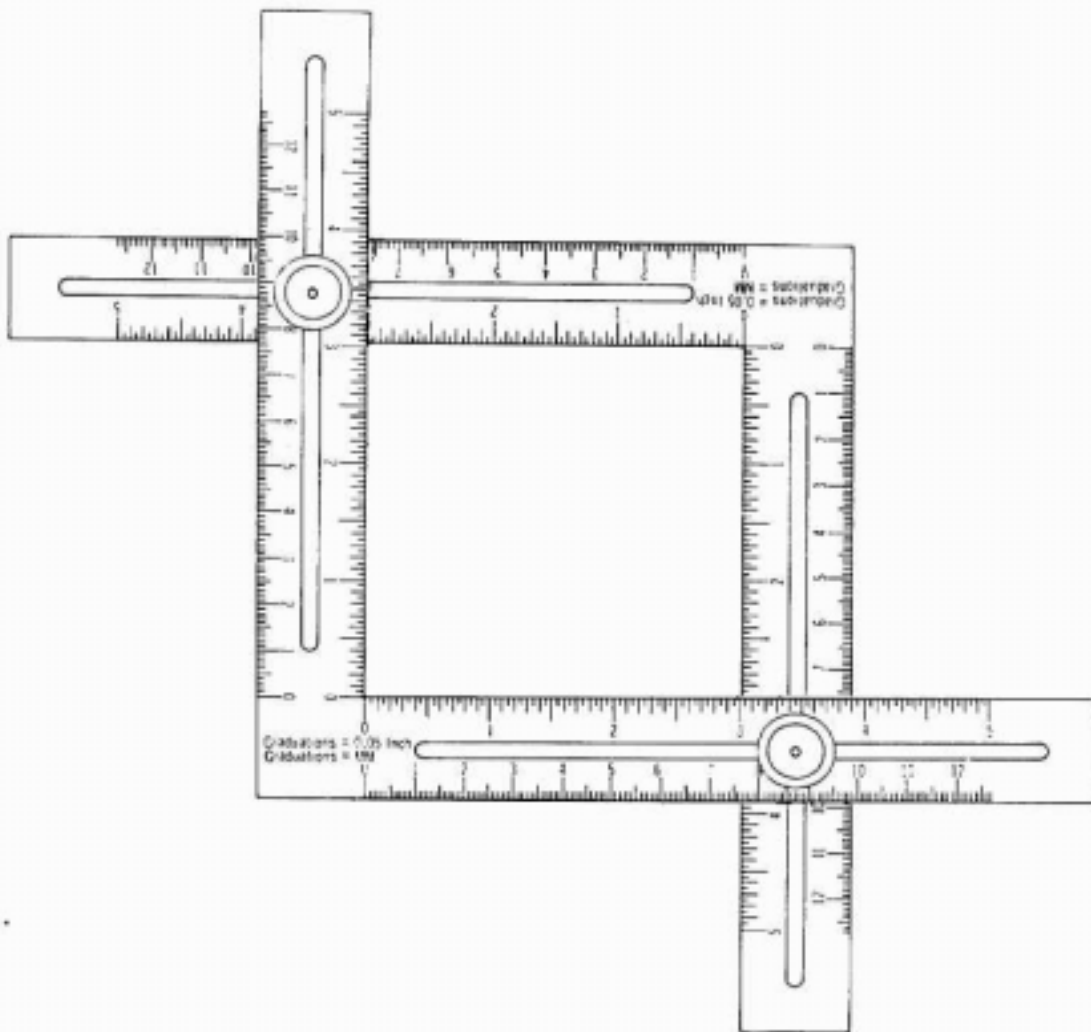


FIGURE 10

